



**A Tribute to
National Aeronautics
and Space Administration
Minority Astronauts:
Past and Present**



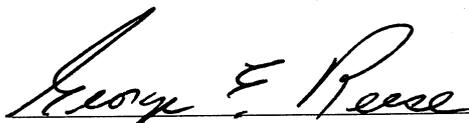
Cover Picture: STS-87-E5104—Astronaut Winston Scott during his second extravehicular activity (EVA) in the cargo bay of the Earth-orbiting Space Shuttle *Columbia*. Scott was assisted in the EVA by Takao Doi (out of frame) and was experimenting with the Autonomous Extravehicular Activity Robotic Camera Sprint (AERCam Sprint). The AERCam Sprint is a prototype free-flying television camera that could be used for remote inspections of the exterior of the International Space Station. This view was taken on December 3, 1997.



ACKNOWLEDGMENT

This brochure is the result of a collaborative effort between the NASA Headquarters Office of Space Flight and Office of Equal Opportunity Programs.

Additional information about all of America's astronauts can be found at the following URL: <http://www.jsc.nasa.gov/Bios/html> or by writing to NASA Headquarters, Code PO-Special Events Section, 300 E Street, SW, Washington, DC 20546.



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FOREWORD

by Former Astronaut Frederick Gregory

The National Aeronautics and Space Administration (NASA) has been selecting astronauts since 1959. The first group was called the "Mercury Seven." These seven men were chosen because of their performance as military officers and test pilots, their character, their intelligence, and their guts. Six of these seven flew in the Mercury capsule.

Several additional groups were chosen between 1959 and 1978. It was an exciting period in the American space program. Many of these astronauts participated in the Gemini and Apollo programs, traveled and walked on the Moon, docked with the Russians during the Apollo-Soyuz Test Project, and occupied America's first space station, the Skylab.

With the onset of the Space Shuttle, a new era began. The astronauts selected in 1978 broke the traditional mold. For the first time, minorities and women became part of America's astronaut corps. Since then, eight additional groups have been selected, with an increasing mix of African American, Hispanic, Latino, Asian/Pacific Islander, and Native American men and women. These astronauts will continue the American space program into the new millennium by continuing flights on the Space Shuttle and participating in the construction and occupancy of the International Space Station. These astronauts, and those who will be chosen in the future, will lead America and its partners to future voyages beyond the influence of Earth's gravity.



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The First Black Astronaut



Major Robert Lawrence, Jr. The First Black Astronaut

On December 7, 1997, almost 30 years to the day after his death in an Air Force plane crash, Major Robert Lawrence, Jr., was recognized as a full-fledged astronaut—the first Black astronaut.

Lawrence was killed in the crash of an F-104 fighter during a training exercise on December 8, 1967, 6 months after he was named to the Air Force's Manned Orbiting Laboratory Program. Had he lived, Lawrence would have likely moved to the National Aeronautics and Space Administration (NASA), as did many of his colleagues when the Air Force canceled the short-lived and unsuccessful Orbiting Laboratory Program in 1969.

By NASA standards, anyone selected for astronaut training is an astronaut. However, by the Air Force standards of the 1960's, the 32-year-old Lawrence, a test pilot with a Ph.D. in chemistry, never earned his astronaut wings because he never flew as high as the required 50 miles, which was one of the requirements to become an astronaut.

Lawrence would have been America's lone Black astronaut until NASA chose three in 1978—Major Frederick D. Gregory, a Shuttle commander; Major Guion S. Bluford, Jr., the first Black American to fly in space; and Ronald E. McNair, who died in the *Challenger* explosion, on January 28, 1986. Lawrence officially was confirmed as an astronaut by the Air Force in January 1996.



Current Astronauts



Michael P. Anderson **Major, USAF** **NASA Astronaut**

Born December 25, 1959, in Plattsburgh, New York, considers Spokane, Washington, his hometown. He enjoys photography, chess, computers, and tennis. He graduated from Cheney High School in Cheney, Washington, in 1977 and has a bachelor of science degree in physics/astronomy from the University of Washington, 1981. His master of science degree is in physics from Creighton University, 1990. After Anderson graduated from the University of Washington in 1981, he was commissioned a second lieutenant.

After completing a year of technical training at Keesler Air Force Base (AFB), Mississippi, he was assigned to Randolph AFB, Texas. At Randolph, he served as Chief of Communication Maintenance for the 2015 Communication Squadron and later as Director of Information System Maintenance for the 1920 Information System Group. In 1986, he was selected to attend undergraduate pilot training at Vance AFB, Oklahoma. Upon graduation, he was assigned to the 2nd Airborne Command and Control Squadron, Offutt AFB, Nebraska, as an EC 135 pilot, flying the Strategic Air Command's airborne command post code named "Looking Glass." From January 1991 to

September 1992, he served as an aircraft commander and instructor pilot in the 920th Air Refueling Squadron, Wurtsmith AFB, Michigan. From September 1992 to February 1995, he was assigned as an instructor pilot and tactics officer in the 380 Air Refueling Wing, Plattsburgh AFB, New York. Anderson has logged more than 3,000 hours in various models of the KC-135 and the T-38A aircraft.

NASA EXPERIENCE: Selected by NASA in December 1994, Anderson reported to the Johnson Space Center (JSC) in March 1995. He completed a year of training and evaluation and is qualified for flight crew assignment as a mission specialist. Anderson was initially assigned technical duties in the Flight Support Branch of the Astronaut Office. Most recently, he flew on the crew of STS-89. In completing his first space flight, Anderson has logged more than 211 hours in space.

SPACE FLIGHT EXPERIENCE: STS-89 (January 22-31, 1998) was the eighth Shuttle-Mir docking mission, during which the crew transferred more than 8,000 pounds of scientific equipment, logistical hardware, and water from the Space Shuttle *Endeavour* to Mir. In the fifth and last exchange of a U.S. astronaut, STS-89 delivered Andy Thomas to Mir and returned with David Wolf. The mission duration was 8 days, 19 hours, and 47 seconds, traveling 3.6 million miles in 138 orbits around Earth.



Yvonne Darlene Cagle (M.D.) NASA Astronaut Candidate (Mission Specialist)

Born April 24, 1959, in West Point, New York, Cagle considers Novato, California, her hometown. She enjoys jigsaw puzzles, juggling, skating, hiking, music, writing, public speaking, and historical novels. She graduated from Novato High School in 1977 and received a bachelor of arts degree in biochemistry from San Francisco State University in 1981 and a doctorate in medicine from the University of Washington in 1985. Her internship was at Transitional Highland General Hospital, Oakland, California, in 1985. Cagle received certification in aerospace medicine from the School of Aerospace Medicine at Brooks AFB, Texas, in 1988 and completed her residency in family practice and GHENTFP at Eastern Virginia Medical School in 1992. She received certification as a senior aviation medical examiner from the Federal Aviation Administration (FAA) in 1995.

Cagle's medical training was sponsored by the Health Professions Scholarship Program, through which she received her commission as a reserve officer with the U.S. Air Force, and subsequently she was awarded her board certification in family practice. During her initial active duty tour at Royal

Air Force Lakenheath, United Kingdom, she was selected to attend the School of Aerospace Medicine at Brooks AFB, Texas. In April 1988, she became certified as a flight surgeon, logging numerous hours in a variety of aircraft. She was actively involved in mission support of aircraft, providing medical support and rescue during several aeromedical missions.

From 1994 to 1996, Cagle served as the Deputy Project Manager for Kelsey-Seybold Clinics, practicing as an occupational physician at the NASA-JSC Occupational Health Clinic. In addition to conducting job-related exams and routine health screenings and providing acute care for onsite injuries and illness, she designed the medical protocols and conducted the screenings for select NASA remote duty operations. Cagle is a certified FAA Senior Aviation Medical Examiner, is ACLS Instructor qualified, and teaches fitness courses. She is a clinical assistant professor at the University of Texas Medical Branch at Galveston. She has served on the Volunteer Family Practice Clinical Faculty at the University of California at Davis. While an Air Force reservist, she was assigned to the Pentagon Flight Medicine/Special Mission Clinic.

NASA EXPERIENCE: During May 1989, while a flight surgeon assigned to the 48th Tactical Hospital, United Kingdom, Cagle volunteered to serve as the Air Force Medical Liaison Officer for the STS-30 *Atlantis* Shuttle mission to test the Magellan spacecraft. She was assigned to the transatlantic landing site at Banjul, West Africa, to provide emergency rescue and evacuation of the Shuttle crew if required. Cagle has contributed ongoing data to the Longitudinal Study on Astronaut Health and has served as a consultant for space telemedicine. She was a member of the NASA working group and traveled to Russia to establish international medical standards and procedures for astronauts. She also conducted health screenings of Mir-18 consultants from the Russian Federation.

Selected by NASA in April 1996, Cagle reported to JSC in August 1996 to begin 2 years of training and evaluation. She has successfully completed her initial training and is now qualified to perform various technical assignments as a mission specialist on a Space Shuttle flight crew.



Fernando (Frank) Caldeiro **NASA Astronaut** **(Mission Specialist)**

Born June 12, 1958, in Buenos Aires, Argentina, Caldeiro considers Merritt Island, Florida, his hometown. He is married to the former Donna Marie Emero of Huntington Beach, California. They have one child. He enjoys building, flying, and racing his own experimental aircraft, snorkeling, and amateur radio (KE4RFI). He graduated from W.C. Bryant High School, Long Island City, New York, in 1976. He received an associate degree in applied science in aerospace technology from the State University of New York at Farmingdale in 1978, a bachelor of science degree in mechanical engineering from the University of Arizona in 1984, and a master of science degree in engineering management from the University of Central Florida in 1995.

From 1985 to 1988, Caldeiro worked as a test director during the production and flight test of the Rockwell/USAF B-1B Bomber. In 1988, he was transferred by Rockwell to the Kennedy Space Center (KSC) as a Space Shuttle main propulsion system specialist. In this capacity, he was the Rockwell design center representative for the ground processing and launch of the orbiter *Discovery*.

NASA EXPERIENCE: Caldeiro was hired by NASA's KSC in 1991 as a cryogenics and propulsion systems expert for the Safety and Mission Assurance Office. He was selected by NASA as an astronaut candidate in April 1996 and reported to JSC in August 1996. He has successfully completed his initial training and is now qualified as a mission specialist.



Franklin R. Chang-Díaz (Ph.D.) NASA Astronaut

Born April 5, 1950, in San José, Costa Rica, to the late Ramón A. Chang-Morales and María Eugenia Díaz de Chang, Chang-Díaz is married to the former Peggy Marguerite Doncaster of Alexandria, Louisiana. They have four children. He enjoys music, glider planes, soccer, scuba-diving, hunting, and hiking. His mother resides in Costa Rica. He graduated from Colegio de la Salle in San José, Costa Rica, in November 1967 and from Hartford High School in Hartford, Connecticut, in 1969. Chang-Díaz received a bachelor of science degree in mechanical engineering from the University of Connecticut in 1973.

Following graduation in 1973, he entered graduate school at the Massachusetts Institute of Technology (MIT). He obtained his doctorate in the field of applied plasma physics and fusion technology from MIT in 1977 and in the same year, joined the technical staff of the Charles Stark Draper Laboratory. In 1979, he developed a novel concept to guide and target fuel pellets in an inertial fusion reactor chamber. As a visiting scientist with the MIT Plasma Fusion Center from October 1983 to December 1993, he led the plasma propulsion program there to develop this technology for future human missions to Mars. In December 1993, Chang-Díaz was appointed Director for the Advanced Space Propulsion Laboratory at JSC, where he continues his research on plasma rockets.

In addition to his main fields of science and engineering, he worked for 2 1/2 years as a house manager in an experimental community residence for de-institutionalizing chronic mental patients, and he was heavily involved as an instructor/advisor with a rehabilitation program for Hispanic drug abusers in Massachusetts.

NASA EXPERIENCE: Selected by NASA in May 1980, Chang-Díaz became an astronaut in August 1981. While undergoing astronaut training, he was also involved in flight software checkout at the Shuttle Avionics Integration Laboratory (SAIL) and participated in the early Space Station design studies. In late 1982, he was designated as support crew for the first Spacelab mission and, in November 1983, served as an orbit capsule communicator (CAPCOM) during that flight. From October 1984 to August 1985, he was leader of the astronaut support team at KSC.

SPACE FLIGHT EXPERIENCE: A veteran of five space flights (STS 61-C in 1986, STS-34 in 1989, STS-46 in 1992, STS-60 in 1994, and STS-75 in 1996), Chang-Díaz has logged more than 1,033 hours in space.



Kalpana Chawla (Ph.D.) NASA Astronaut

Born in Karnal, India, Chawla enjoys flying, hiking, backpacking, and reading. She holds a Certificated Flight Instructor's license and Commercial Pilot's licenses for single and multi-engine land airplanes and single-engine seaplanes, instrument rating, and private glider. She enjoys flying aerobatics and tail-wheel airplanes.

Chawla graduated from Tagore School, Karnal, India, in 1976. She has a bachelor of science degree in aeronautical engineering from Punjab Engineering College, India, 1982, a master of science degree in aerospace engineering from the University of Texas, 1984, and a doctorate of philosophy in aerospace engineering from the University of Colorado, 1988.

In 1988, Chawla started work at NASA's Ames Research Center in the area of powered-lift computational fluid dynamics. Her research concentrated on simulation of complex air flows encountered around aircraft such as the Harrier in "ground-effect." Following completion of this project, she supported research in the mapping of flow solvers to parallel computers and in the testing of these solvers by carrying out powered-lift computations. In 1993, Chawla joined

Overset Methods Inc., Los Altos, California, as Vice President and Research Scientist to form a team with other researchers specializing in the simulation of moving multiple body problems. She was responsible for the development and implementation of efficient techniques to perform aerodynamic optimization. Results of various projects in which Chawla participated are documented in technical conference papers and journals.

NASA EXPERIENCE: Selected by NASA in December 1994, Chawla reported to JSC in March 1995 as an astronaut candidate in the 15th group of astronauts. After completing a year of training and evaluation, she was assigned to work technical issues for the Astronaut Office EVA/Robotics and Computer Branches. Most recently, Chawla served as mission specialist on STS-87 (November 19 to December 5, 1997). STS-87 was the fourth U.S. Microgravity Payload flight and focused on experiments designed to study how the weightless environment of space affects various physical processes, as well as on observations of the Sun's outer atmospheric layers. Two members of the crew performed an EVA (spacewalk), which featured the manual capture of a Spartan satellite, in addition to testing EVA tools and procedures for future Space Station assembly. In completing her first mission, Chawla traveled 6.5 million miles in 252 orbits of Earth and logged 376 hours and 34 minutes in space.



Leroy Chiao (Ph.D.) NASA Astronaut

Born August 28, 1960, in Milwaukee, Wisconsin, Chiao considers Danville, California, his hometown. He is single and enjoys flying, basketball, racquetball, and skiing. His parents reside in Fairfield, California. He graduated from Monte Vista High School, Danville, California, in 1978. He received a bachelor of science degree in chemical engineering from the University of California, at Berkeley in 1983 and a master of science degree and a doctorate in chemical engineering from the University of California, Santa Barbara, in 1985 and 1987, respectively.

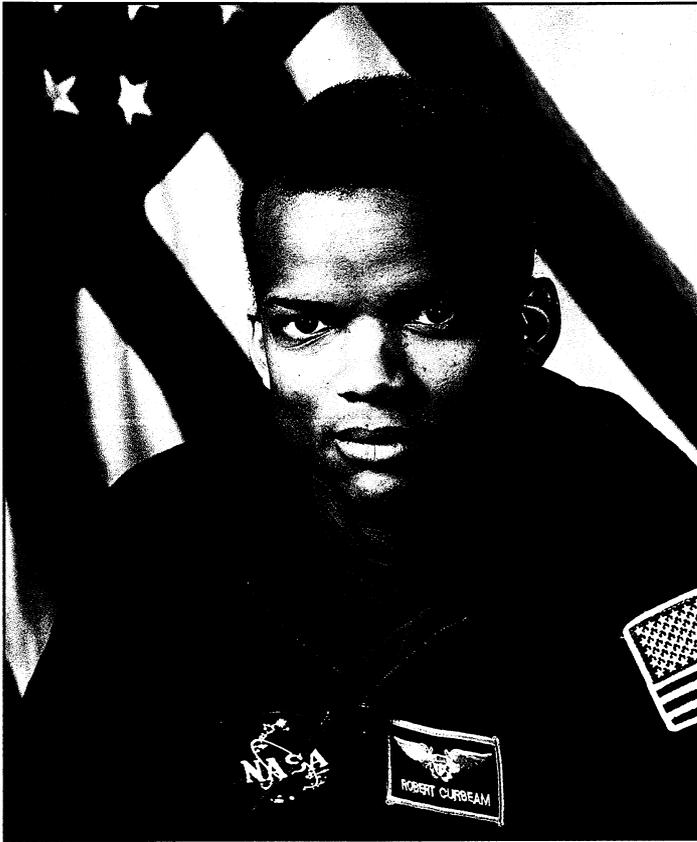
NASA EXPERIENCE: After graduating from the University of California at Santa Barbara, Chiao joined the Hexcel Corporation in Dublin, California. He worked for Hexcel until 1989, during which time he was involved in process, manufacturing, and engineering research on advanced aerospace materials. He worked on a joint NASA-JPL/Hexcel project to develop a practical, optically correct, precision segment reflector, made entirely of advanced polymer composite materials, for future space telescopes, as well as on cure modeling

and finite element analysis. In January 1989, Chiao joined the Lawrence Livermore National Laboratory in Livermore, California, where he was involved in processing research for the fabrication of filament-wound and thick-section aerospace composites. He also developed and demonstrated a mechanistic cure model for graphite fiber/epoxy composite material. An instrument-rated pilot, Chiao has logged more than 1,500 flight hours in a variety of aircraft.

Selected by NASA in January 1990, Chiao became an astronaut in July 1991. He is qualified for flight assignment as a mission specialist. His technical assignments to date include: Space Shuttle flight software verification in the Shuttle Avionics Integration Laboratory (SAIL); crew equipment, Spacelab, Spacehab, and payloads issues for the Astronaut Office Mission Development Branch; training and flight data file issues; and EVA issues for the EVA Branch. A veteran of two space flights, he flew as a mission specialist on STS-65 in 1994 and STS-72 in 1996. Chiao has logged 567 hours, 55 minutes, and 41 seconds in space, including two space walks totaling just over 13 hours. He is assigned as a mission specialist on STS-92, the second Space Shuttle mission to assemble the International Space Station launch, which is scheduled for January 1999.

SPACE FLIGHT EXPERIENCE: STS-65 (July 8-23, 1984) launched from and returned to land at KSC, Florida, setting a new flight duration record for the Space Shuttle program at that time. The STS-65 mission flew the second International Microgravity Laboratory (IML-2). During the 15-day flight, the seven-member crew aboard *Columbia* conducted more than 80 experiments focusing on materials and life sciences research in microgravity. The mission was accomplished in 236 orbits of Earth, traveling 6.1 million miles in 353 hours and 55 minutes.

STS-72 (January 11-20, 1996) was a 9-day mission during which the crew aboard *Endeavour* retrieved the Space Flyer Unit (launched from Japan 10 months earlier), and deployed and retrieved the OAST-Flyer. Chiao performed two spacewalks designed to demonstrate tools and hardware and to evaluate techniques to be used in the assembly of the International Space Station. In completing this mission, Chiao logged a total of 214 hours and 41 seconds in space, including just over 13 EVA hours, and traveled 3.7 million miles in 142 orbits of Earth.



Robert L. Curbeam, Jr.
Lieutenant Commander, USN
NASA Astronaut

Born March 5, 1962, in Baltimore, Maryland, Curbeam is married to the former Julie Dawn Lein, with two children. He enjoys weightlifting, biking, and family activities. He graduated from Woodlawn High School, Baltimore County, Maryland, 1980. He has a bachelor of science degree in aerospace engineering from the U.S. Naval Academy, 1984, a master of science degree in aeronautical engineering from the Naval Postgraduate School, 1990, and a degree of aeronautical and astronautical engineering from the Naval Postgraduate School, 1991.

Upon graduation from the U.S. Naval Academy, Curbeam commenced Naval Flight Officer training in 1984. In 1986, he reported to Fighter Squadron 11 and made overseas deployments to the Mediterranean and Caribbean Seas and the Arctic and Indian Oceans onboard the *USS Forrestal* (CV-59). Upon completion of Test Pilot School in December 1991, he reported to the Strike Aircraft Test Directorate, where he was the project officer for the F-14A/B Air-to-Ground Weapons Separation Program. In August 1994, he returned to the U.S. Naval Academy as an instructor in the Weapons and Systems Engineering Department.

NASA EXPERIENCE: Selected by NASA in December 1994, Curbeam reported to the JSC in March 1995. He completed a year of training and evaluation and was assigned to the Computer Support Branch of the Astronaut Office. In 1997, he flew as a mission specialist on STS-85. In completing his first flight, Curbeam logged 284 hours and 27 minutes in space. He is assigned to serve on the crew of STS-99 and is currently in training preparing for the spacewalks required for on orbit construction of the International Space Station. STS-99 is targeted for launch in the summer of 1999.

SPACE FLIGHT EXPERIENCE: STS-85 (August 7-19, 1997) was a 12-day mission during which the crew deployed and retrieved the CRISTA-SPAS payload, operated the Japanese Manipulator Flight Demonstration robotic arm, studied changes in Earth's atmosphere, and tested technology destined for use on the future International Space Station. The mission was accomplished in 189 Earth orbits, traveling 4.7 million miles in 284 hours and 27 minutes.



John Bennett Herrington
Lieutenant Commander, USN
NASA Astronaut
(Mission Specialist)

Born September 14, 1958, in Wetumka, Oklahoma, Herrington grew up in Colorado Springs, Colorado; Riverton, Wyoming; and Plano, Texas. He is married to the former Debra Ann Farmer of Colorado Springs, Colorado. They have two children. He enjoys rock climbing, snow skiing, running, and cycling. He graduated from Plano Senior High School, Plano, Texas, in 1976. Herrington received a bachelor of science degree in applied mathematics from the University of Colorado at Colorado Springs, in 1983 and a master of science degree in aeronautical engineering from the U.S. Naval Postgraduate School in 1995.

Herrington received his commission from Aviation Officer Candidate School in March 1984 and was designated a Naval Aviator in March 1985. He reported to Patrol Squadron Thirty-One (VP-31) at the Moffett Field Naval Air Station, Mountain View, California, for initial training in the P-3C Orion. His first operational assignment was with Patrol Squadron Forty-Eight (VP-48) where he made three operational deployments, two to the Northern Pacific based from Naval Air Station, Adak, Alaska, and one to the Western

Pacific based from the Naval Air Station, Cubi Point, Republic of the Philippines. While assigned to VP-48, Herrington was designated a Patrol Plane Commander, Mission Commander, and Patrol Plane Instructor Pilot. Following completion of his first operational tour, Herrington then returned to VP-31, as a Fleet Replacement Squadron Instructor Pilot. While assigned to VP-31, he was selected to attend the U.S. Naval Test Pilot School in Patuxent River, Maryland in January 1990.

After graduation in December 1990, he reported to the Force Warfare Aircraft Test Directorate as a project test pilot for the Joint Primary Aircraft Training System. Herrington conducted additional flight test assignments, flying numerous variants of the P-3 Orion as well as the T-34C and the DeHavilland Dash 7. Following his selection as an Aeronautical Engineering Duty Officer, Herrington reported to the U.S. Naval Postgraduate School, where he completed a master of science degree in aeronautical engineering in June 1995. Herrington was assigned as a Special Projects Officer to the Bureau of Naval Personnel's Sea Duty Component when selected for the astronaut program.

NASA EXPERIENCE: Herrington was selected by NASA in April 1996 and reported to JSC in August 1996.



Joan E. Higginbotham NASA Astronaut (Mission Specialist)

Born August 3, 1964, in Chicago, Illinois, she enjoys body building (weightlifting), cycling, music, and motivational speaking. She graduated from Whitney M. Young Magnet High School, Chicago, Illinois, in 1982, received a bachelor of science degree in electrical engineering from Southern Illinois University at Carbondale in 1987, and earned a masters degree in management and in space systems from the Florida Institute of Technology in 1992 and 1996, respectively.

NASA EXPERIENCE: Higginbotham began her career in 1987 at KSC, Florida, as a Payload Electrical Engineer in the Electrical and Telecommunications Systems Division. Within 6 months, she became the lead for the Orbiter Experiments on OV-102, the Space Shuttle *Columbia*. Later, she worked on the Shuttle payload bay reconfiguration for all Shuttle missions. She was also tasked by KSC management to undertake several special assignments in which she served as the Executive Staff Assistant to the Director of Shuttle Operations and Management, led a team of engineers in per-

forming critical analysis for the Space Shuttle flow in support of a simulation model tool, and was involved in working on an interactive display to show detailed Shuttle processing procedures at Spaceport USA.

Higginbotham was promoted to Lead Orbiter Project Engineer for OV-102 after 2 years as an orbiter project engineer for OV-104, the Space Shuttle *Atlantis*. She held the technical lead government engineering position in the firing room, where she supported and managed the integration of vehicle testing and troubleshooting.

Selected as an astronaut candidate by NASA in April 1996, Higginbotham reported to JSC in August 1996. She has successfully completed her initial training, and she is now qualified for various technical assignments as a mission specialist on a Space Shuttle flight crew.



Michael E. Lopez-Alegria **Commander, USN** **NASA Astronaut**

Born May 30, 1958, in Madrid, Spain, Lopez-Alegria considers both Madrid, Spain, and Mission Viejo, California, his hometowns. He is married to the former Daria Robinson of Geneva, Switzerland. He enjoys sports, traveling, and cooking. He graduated from Mission Viejo High School, Mission Viejo, California, in 1976, received a bachelor of science degree in systems engineering from the U.S. Naval Academy in 1980.

Following flight training, Lopez-Alegria was designated a Naval Aviator on September 4, 1981. He then served as a flight instructor in Pensacola, Florida, until March 1983. His next assignment was to a fleet electronic reconnaissance squadron in Rota, Spain. In 1986, he was assigned to a 2-year cooperative program between the Naval Postgraduate School in Monterey, California, and the U.S. Naval Test Pilot School in Patuxent River, Maryland. His final tour before being assigned to NASA was at the Naval Air Test Center as an engineering test pilot and program manager. He earned a master of science degree in aeronautical engineering from the U.S. Naval Postgraduate School in 1988.

NASA EXPERIENCE: Selected by NASA in March 1992, Lopez-Alegria reported for training to JSC in August 1992. His next assignment was to KSC where he provided crew representation on orbiter processing issues and provided direct crew support during launches and landings.

SPACE FLIGHT EXPERIENCE: From October 20 to November 5, 1995, Lopez-Alegria served as a mission specialist and flight engineer aboard Space Shuttle *Columbia* on STS-73, the second United States Microgravity Laboratory mission. The mission focused on materials science, biotechnology, combustion science, the physics of fluids, and numerous scientific experiments housed in the pressurized Spacelab module. Lopez-Alegria served as the flight engineer during the ascent and entry phases of flight, and he was responsible for all operations of the "blue" shift on orbit. In completing his first space flight, Lopez-Alegria orbited Earth 256 times, traveled over 6 million miles, and logged a total of 15 days, 21 hours, 52 minutes, and 21 seconds in space. Most recently, Lopez-Alegria served as NASA Director of Operations at the Yuri Gagarin Cosmonaut Training Center, Star City, Russia. He is currently assigned as a mission specialist on STS-92, scheduled for launch in January 1999.



Christopher J. "Gus" Loria
Major, USMC
NASA Astronaut
(Pilot)

Born July 9, 1960, in Newton, Massachusetts, Loria considers Belmont, Massachusetts, his hometown. He is married to the former Sandra Lee Sullivan, R.N., of Oklahoma City, Oklahoma. They have two children. He enjoys running, cycling, weight training, sailing, hiking, fishing, and hunting. Loria graduated from Belmont High School in 1978, and from the U.S. Naval Academy Preparatory School in 1979. He has received a bachelor of science degree in general engineering from the U.S. Naval Academy in 1983 and is currently completing his thesis for a master of science degree in aeronautical engineering from the Florida Institute of Technology.

Loria received his commission from the Naval Academy in 1983 and was designated a Naval Aviator in July 1988. He transitioned to the F/A-18 Hornet with Strike Fighter Squadron 125 (VFA-125) at the Naval Air Station Lemoore, California, during August 1988 through August 1989. His next assignment was with Marine Fighter Attack Squadron 314 (VMFA-314), the "Black Knights," at Marine Corps Air Station, El Toro, California, where he served as squadron pilot and performed collateral duties as the Quality

Assurance Officer and Assistant Maintenance Officer in the Squadron Aircraft Maintenance Department. While assigned to the Black Knights, he deployed to Bahrain for Operations Desert Shield and Desert Storm, where he flew 42 combat missions in support of allied operations. In 1992, while assigned as an instructor pilot to Marine Fighter Attack Training Squadron 101 (VMFAT-101), he was selected for the U.S. Air Force Test Pilot School at Edwards Air Force Base, California. From January 1994 to July 1996, he was assigned to the Strike Aircraft Test Squadron, Naval Air Station, Patuxent River, Maryland, as an experimental test pilot.

NASA EXPERIENCE: Previous NASA experience includes an assignment as a test pilot and Project Officer for the Department of the Navy on the X-31 Program at the NASA Dryden Flight Research Center, Edwards AFB, California, from July 1994 to June 1995. He was also test pilot on Dryden's F/A-18 High Alpha Research Vehicle, or "HARV," during March 1995, conducting spin testing and the first successful excitation of the Hornet Falling Leaf out-of-control mode during flight test. He participated in physiology testing of the prototype High Altitude & G System (or HAGS), which is a combination g-suit and partial pressure suit for NASA Dryden's F-16XL program. He was the Department of the Navy's lead test pilot on the prestigious NASA/U.S. Navy/Industry Aircraft Control Power Working Group. Selected by NASA in April 1996, Loria reported to the JSC in August 1996 to begin 2 years of training and evaluation. Successful completion of initial training will qualify him for various technical assignments, leading to selection as a pilot on a Space Shuttle flight crew.



**Edward Tsang Lu (Ph.D.)
NASA Astronaut
(Mission Specialist)**

Born July 1, 1963, in Springfield, Massachusetts, Lu considers Honolulu, Hawaii, and Webster, New York, his hometowns. He is single and enjoys aerobatic flying, coaching wrestling, piano, tennis, surfing, skiing, and travel. His parents, Charlie and Snowlily Lu, reside in Fremont, California. He graduated from R.L. Thomas High School, Webster, New York, in 1980 and received a bachelor of science degree in electrical engineering from Cornell University, 1984, and a doctorate in applied physics from Stanford University, 1989.

NASA EXPERIENCE: Selected by NASA in December 1994, Lu reported to JSC in March 1995, has completed a year of training and evaluation, and is qualified for assignment as a mission specialist. He was initially assigned to work technical issues in the Computer Support Branch of the Astronaut Office. Most recently, he served as a mission specialist on STS-84 (May 15-24, 1997), NASA's sixth Shuttle mission to rendezvous and dock with the Russian space station Mir. In completing this 9-day mission, Lu traveled 3.6 million miles in 144 orbits of Earth, logging a total of 221 hours and 20 minutes in space.



Carlos I. Noriega **Lieutenant Colonel, USMC** **NASA Astronaut**

Born October 8, 1959, in Lima, Peru, Noriega considers Santa Clara, California, his hometown. He is married to the former Wendy L. Thatcher. They have five children. He enjoys flying, running, snow skiing, racquetball, and spending time with his children. He graduated from Wilcox High School, Santa Clara, California, in 1977. Noriega has a bachelor of science degree in computer science from the University of Southern California, 1981, a master of science degree in computer science from the Naval Postgraduate School, 1990, and a master of science degree in space systems operations from the Naval Postgraduate School, 1990.

Noriega was a member of the Navy ROTC unit and received his commission in the U.S. Marine Corps at the University of Southern California in 1981. Following graduation from flight school, he flew CH-46 Sea Knight helicopters with HMM-165 from 1983 to 1985 at Marine Corps Air Station (MCAS), Kaneohe Bay, Hawaii. In 1986, he was transferred to MCAS Tustin, California, where he served as the aviation safety officer and instructor pilot with HMT-301. In 1988, Noriega was selected to attend the Naval Postgraduate School

in Monterey, California, where he earned two master of science degrees. Upon graduation in September 1990, he was assigned to U.S. Space Command in Colorado Springs, Colorado.

NASA EXPERIENCE: Selected by NASA in December 1994, Noriega reported to JSC in March 1995. He completed a year of training and evaluation and was qualified for assignment as a mission specialist in May 1996.

SPACE FLIGHT EXPERIENCE: Noriega served as a mission specialist on STS-84 (May 15-24, 1997), NASA's sixth Shuttle mission to rendezvous and dock with the Russian space station Mir. Noriega will serve on the crew of STS-97, the fourth Space Shuttle mission to carry hardware to space for the assembly of the International Space Station. He is scheduled to conduct two spacewalks on this mission. Launch is targeted for the spring of 1999.



Ellen Ochoa (Ph.D.) **NASA Astronaut**

Born May 10, 1958, in Los Angeles, California, Ochoa considers La Mesa, California, her hometown. She is married to Coe Fulmer Miles of Molalla, Oregon. She is a classical flutist and private pilot, and she also enjoys volleyball and bicycling. Ochoa graduated from Grossmont High School, La Mesa, California, in 1975, received a bachelor of science degree in physics from San Diego State University in 1980, and earned a master of science degree and doctorate in electrical engineering from Stanford University in 1981 and 1985, respectively.

As a doctoral student at Stanford, and later as a researcher at Sandia National Laboratories and NASA's Ames Research Center, Ochoa investigated optical systems for performing information processing. She is a co-inventor on three patents for an optical inspection system, an optical object recognition method, and a method for noise removal in images. As Chief of the Intelligent Systems Technology Branch at Ames, she supervised 35 engineers and scientists in the research and development of computational systems for aerospace missions. Ochoa has presented numerous papers at technical conferences and in scientific journals.

NASA EXPERIENCE: Selected by NASA in January 1990, Ochoa became an astronaut in July 1991. A veteran of two space flights, she has logged more than 484 hours in space. She currently serves as a spacecraft communicator (CAPCOM) at Mission Control.

SPACE FLIGHT EXPERIENCE: In April 1993, Ochoa flew as a mission specialist on STS-56, carrying ATLAS-2. She was the payload commander on the STS-66 ATLAS-3 mission (November 3-14, 1994). ATLAS-3 continues the series of Spacelab flights to study the energy of the Sun during an 11-year solar cycle and to learn how changes in the Sun's irradiance affect Earth's climate and environment. Ochoa used the Remote Manipulation System to retrieve the CRISTA-SPAS atmospheric research satellite at the end of its 8-day free flight.



Mark L. Polansky **NASA Astronaut**

Born June 2, 1956, in Paterson, New Jersey, Polansky considers Edison, New Jersey, his hometown. He enjoys ice hockey, snow skiing, light aircraft flying, music, and the arts. His parents, Irving and Edith Polansky, reside in Edison, New Jersey. Polansky graduated from John P. Stevens High School, Edison, New Jersey, in 1974; he then received a bachelor of science degree in aeronautical and astronautical engineering and a master of science degree in aeronautics and astronautics from Purdue University, both in 1978.

NASA EXPERIENCE: Polansky joined NASA in August 1992 as an aerospace engineer and research pilot. He was assigned to the Aircraft Operations Division of JSC. His primary responsibilities involved teaching the astronaut pilots Space Shuttle landing techniques in the Shuttle trainer aircraft and instructing astronaut pilots and mission specialists in the T-38 aircraft. Polansky also conducted flight testing of the NASA T-38 avionics upgrade aircraft.

Selected by NASA in April 1996, Polansky reported to JSC in August 1996. Having 2 years of training and evaluation, he is qualified for flight assignment as a pilot. Currently, Polansky is assigned to the Astronaut Office Flight Support Branch, for which he serves as a member of the Astronaut Support Personnel team at the KSC, supporting Space Shuttle launches and landings.



Winston E. Scott
Captain, USN
NASA Astronaut
(Mission Specialist)

Born August 6, 1950, in Miami, Florida, Scott is married to the former Marilyn K. Robinson and they have two children. He enjoys martial arts and holds a second degree black belt in Shotokan karate. He also enjoys music, and plays trumpet with a Houston-based big band. In addition to flying general aviation aircraft, he is an electronics hobbyist.

He graduated from Coral Gables High School, Coral Gables, Florida, in 1968. He received a bachelor of arts degree in music from Florida State University in 1972 and a master of science degree in aeronautical engineering from the U.S. Naval Postgraduate School in 1980.

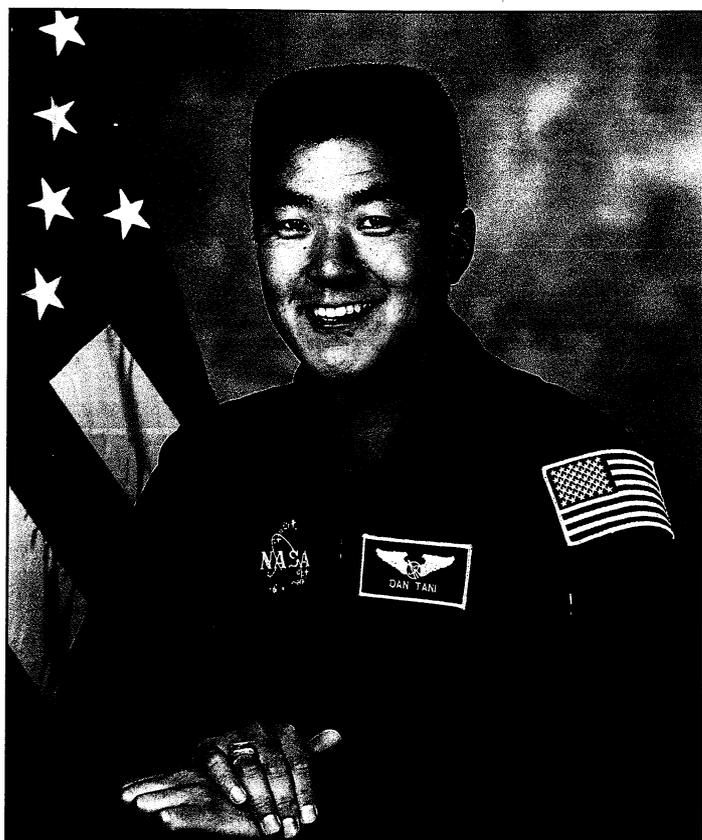
Scott entered Naval Aviation Officer Candidate School after graduation from Florida State University in December 1972. He completed flight training in fixed-wing and rotary-wing aircraft and was designated a Naval Aviator in August 1974.

He then served a 4-year tour of duty with Helicopter Anti-Submarine Squadron Light Thirty Three (HSL-33) at the Naval Air Station, North Island, California, flying the SH-2F Light Airborne Multi-Purpose System (LAMPS) helicopter. In 1978, Scott was selected to attend the Naval Postgraduate School at Monterey, California, where he earned his master of science degree in aeronautical engineering with avionics.

NASA EXPERIENCE: Scott was selected by NASA in March 1992 and reported to JSC in August 1992. He served as a mission specialist on STS-72 in 1996 and STS-87 in 1997, and he has logged a total of 24 days, 14 hours, and 34 minutes in space, including three spacewalks totaling 19 hours and 26 minutes.

SPACE FLIGHT EXPERIENCE: STS-72 on *Endeavour* (January 11-20, 1996) was a 9-day flight during which the crew retrieved the Space Flyer Unit satellite (launched from Japan 10 months earlier), deployed and retrieved the OAST-Flyer satellite, and conducted two spacewalks to demonstrate and evaluate techniques to be used in the assembly of the International Space Station. The mission was accomplished in 142 orbits of Earth, traveling 3.7 million miles, and logged Scott a total of 214 hours and 41 seconds in space, including his first EVA of 6 hours and 53 minutes.

STS-87 (November 19 to December 5, 1997) was the fourth U.S. Microgravity Payload flight and focused on experiments designed to study how the weightless environment of space affects various physical processes and on observations of the Sun's outer atmospheric layers. Scott performed two spacewalks. The first, a 7-hour, 43-minute EVA, featured the manual capture of a Spartan satellite, in addition to testing EVA tools and procedures for future Space Station assembly. The second spacewalk lasted 5 hours and also featured Space Station assembly tests. The mission was accomplished in 252 Earth orbits, traveling 6.5 million miles in 376 hours and 34 minutes.



Daniel M. Tani
NASA Astronaut
(Mission Specialist)

Born February 1, 1961, in Ridley Park, Pennsylvania, Tani considers Lombard, Illinois, his hometown. He is single and enjoys golf, flying, running, tennis, music, and cooking. His mother, Rose Tani, resides in Lombard, Illinois. His father, Henry N. Tani, is deceased. Tani graduated from Glenbard East High School, Lombard, Illinois, in 1979. He received a bachelor and a master of science degree in mechanical engineering from the Massachusetts Institute of Technology (MIT) in 1984 and 1988, respectively.

NASA EXPERIENCE: Selected as an astronaut candidate by NASA in April 1996, Tani reported to JSC in August 1996. Having completed 2 years of training and evaluation, he is qualified for flight assignment as a mission specialist. Currently, Tani is assigned technical duties in the Astronaut Office's Computer Support Branch. In 1988, Tani joined Orbital Sciences Corporation (OSC) in Dulles, Virginia, initially as a senior structures engineer, and then as the mission operations manager for the Transfer Orbit Stage (TOS). In that role, he served as the TOS flight operations lead, working with NASA/JSC mission control in support of the deployment of the ACTS/TOS payload during the STS-51 mission

in September 1993. Tani then moved to the Pegasus program at OSC as the launch operations manager. In that capacity, he served as lead for the development of procedures and constraints for the launching of the air-launched Pegasus unmanned rocket. Tani also was responsible for defining, training, and leading the team of engineers who worked in the launch and control room.



Stephanie D. Wilson **NASA Astronaut** **(Mission Specialist)**

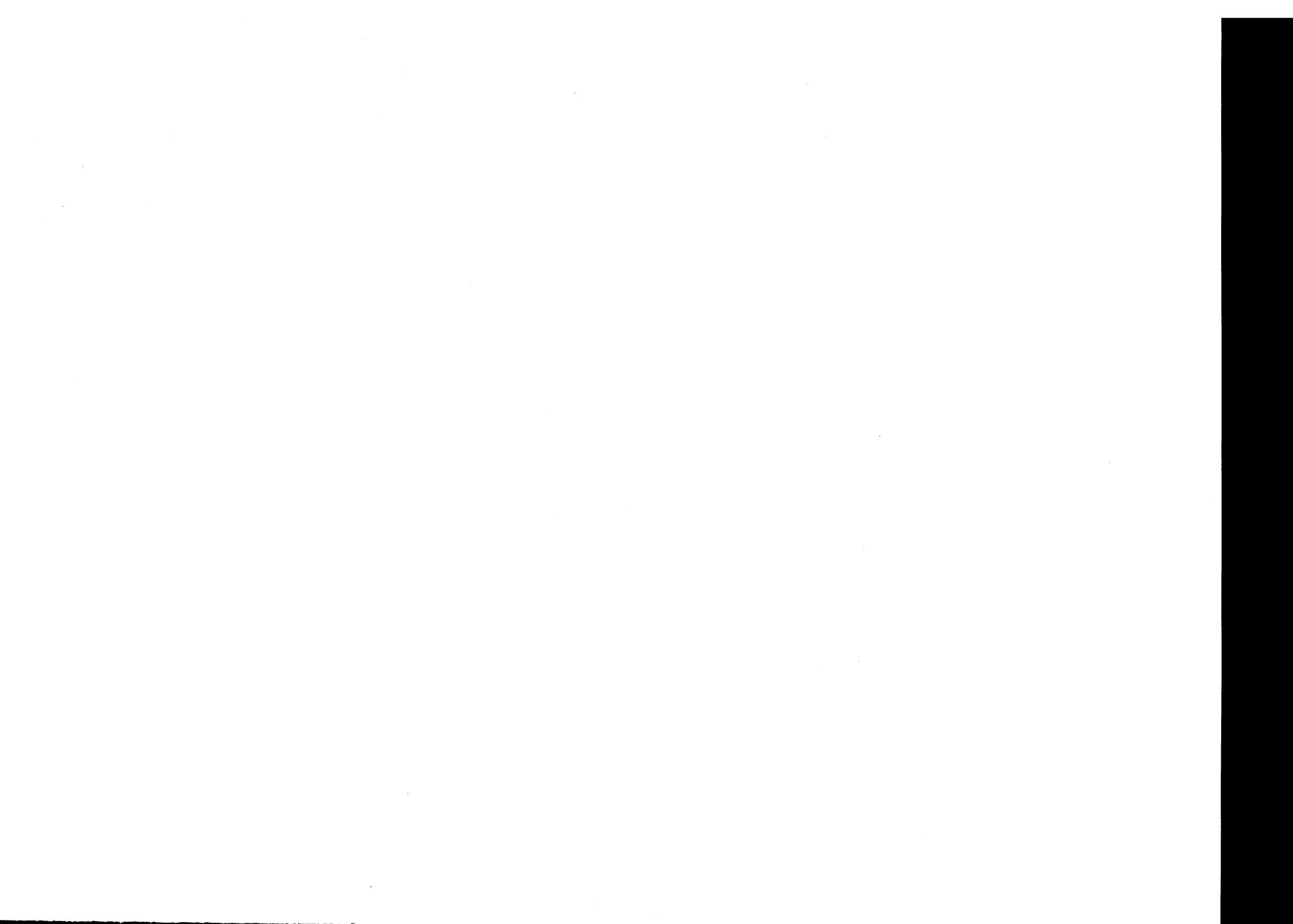
Born September 27, 1966, in Boston, Massachusetts, Wilson enjoys snow skiing, music, astronomy, stamp collecting, and traveling. She graduated from Taconic High School, Pittsfield, Massachusetts, in 1984. She received a bachelor of science degree in engineering science from Harvard University in 1988 and a master of science degree in aerospace engineering from the University of Texas in 1992.

After graduating from Harvard in 1988, Wilson worked for 2 years for the former Martin Marietta Astronautics Group in Denver, Colorado. As a loads and dynamics engineer for Titan IV, Wilson was responsible for performing coupled loads analyses for the launch vehicle and payloads during flight events. Wilson left Martin Marietta in 1990 to attend graduate school at the University of Texas. Her research focused on the control and modeling of large, flexible space structures.

Following the completion of her graduate work, she began working for the Jet Propulsion Laboratory in Pasadena, California in 1992. As a member of the Attitude and Articulation Control Subsystem for the Galileo spacecraft, Wilson was responsible for assessing attitude controller per-

formance, science platform pointing accuracy, antenna pointing accuracy, and spin rate accuracy. She worked in the areas of sequence development and testing as well. While at the Jet Propulsion Laboratory, Wilson also supported the Interferometry Technology Program as a member of the Integrated Modeling Team, which was responsible for finite element modeling, controller design, and software development.

NASA EXPERIENCE: Selected by NASA in April 1996, Wilson reported to JSC in August 1996. She has successfully completed her initial training and is now qualified for various technical assignments as a mission specialist on a Space Shuttle flight crew.



Former Astronauts



Guion S. Bluford, Jr.
Colonel
U.S. Air Force (Retired)

Born November 22, 1942, in Philadelphia, Pennsylvania, Bluford received a bachelor of science in aerospace engineering from Pennsylvania State University, a master of science and doctorate of philosophy in aerospace engineering from the Air Force Institute of Technology, and a master in business administration, University of Houston, Clear Lake.

Bluford flew on STS-8, STS 61-A, STS-39, and STS-53. He accumulated more than 688 hours of space flight. He was the first African American astronaut in space.



Charles F. Bolden, Jr.
Major General
U.S. Marine Corps

Born August 19, 1946, in Columbia, South Carolina, Bolden received a bachelor of science in electrical science from the U.S. Naval Academy and a master of science in systems management from the University of Southern California.

He flew on STS 61-C, STS-31, STS-45, and STS-60. His cumulative hours of space flight totaled more than 680.



Frederick D. Gregory
Colonel
U.S. Air Force (Retired)

Born January 7, 1941, in Washington, D.C., Gregory received a bachelor of science from the U.S. Air Force Academy and a master of science in information systems from George Washington University.

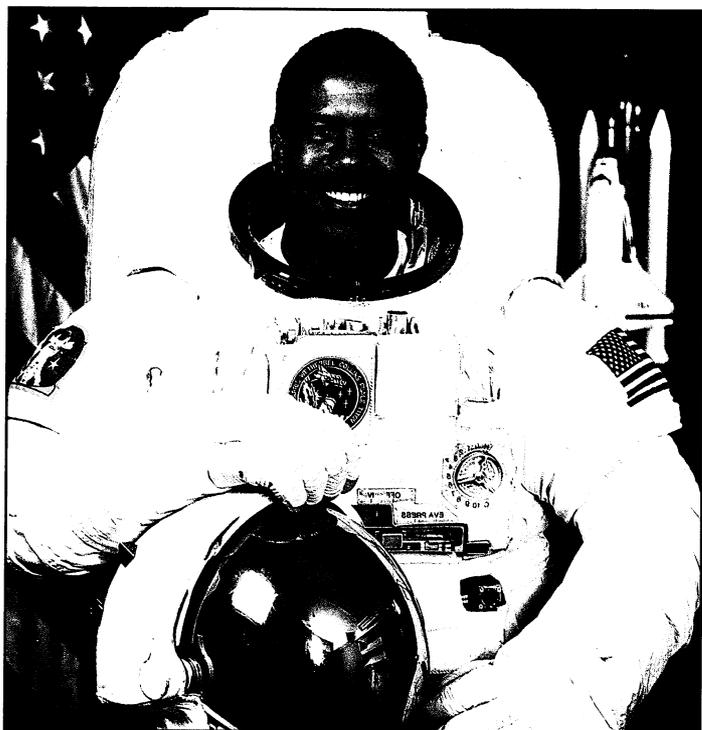
He flew on STS 51-B, STS-33, and STS-44. He accumulated more than 455 hours of space flight. He was the first African American astronaut to pilot and serve as commander of the Space Shuttle.



Sidney M. Gutierrez
Lieutenant Colonel
U.S. Air Force (Retired)

Born June 27, 1951, in Albuquerque, New Mexico, Gutierrez received a bachelor of science in aeronautical engineering from the U.S. Air Force Academy and a master of arts in management from Webster College.

He flew on STS-40 and STS-59, accumulating more than 488 hours of space flight. He was the first Hispanic astronaut in space.



Bernard A. Harris, Jr.
Civilian

Born June 26, 1956, in Temple, Texas, Harris received a bachelor of science in biology from the University of Houston and a doctorate of medicine from Texas Tech University.

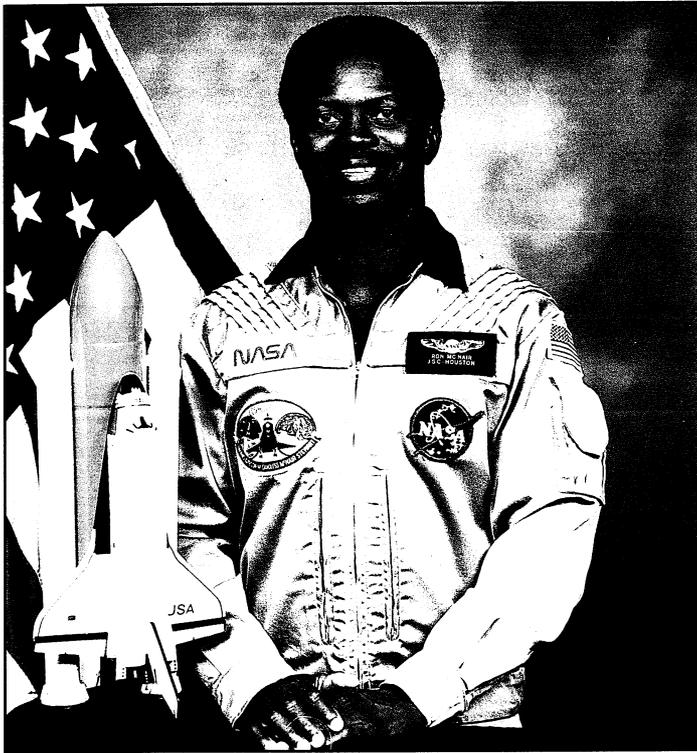
He flew on STS-55 and STS-63. His cumulative hours of space flight are more than 438. His cumulative EVA time is more than 4 hours. He was the first African American to perform a spacewalk.



Mae C. Jemison
Civilian

Born October 17, 1956, in Decatur, Alabama, Jemison received a bachelor of science in chemical engineering from Stanford University and a doctorate of medicine from Cornell University.

She flew on STS-47. Her cumulative hours of space flight are more than 190. She was the first African American female in space.



Ronald E. McNair **Civilian**

Born October 21, 1950, in Lake City, South Carolina, McNair received a bachelor of science in physics from North Carolina A&T State College and a doctorate of philosophy in physics from the Massachusetts Institute of Technology.

He flew on STS 41-B. His cumulative hours of space flight were more than 191. He died on January 28, 1986, in the STS 51-L (*Challenger*) accident.



Ellison S. Onizuka **Lieutenant Colonel** **U.S. Air Force**

Born June 24, 1946, in Kealahou, Kona, Hawaii, Onizuka earned bachelor and master of science degrees in aerospace engineering from the University of Colorado.

He flew on STS 51-C. His cumulative hours of space flight were more than 73. He died on January 28, 1986, in the STS 51-L 9 (*Challenger*) accident.



Frequently Asked Questions



FREQUENTLY ASKED QUESTIONS CONCERNING THE SPACE PROGRAM

How can I become an astronaut?

Any adult man or woman in excellent physical condition who meets the basic qualifications can be selected to enter astronaut training. For mission specialists and pilot astronauts, the minimum requirements include a bachelor's degree in engineering, science or mathematics from an accredited institution. Three years of related experience must follow the degree, and an advanced degree is desirable. Pilot astronauts must have at least 1,000 hours of experience in jet aircraft, and they need better vision than mission specialists. Competition is extremely keen, with an average of more than 4,000 applicants for about 20 openings every 2 years. Astronaut recruiting occurs periodically. For more information, see *Astronaut Selection and Training* or write to the Astronaut Selection Office, NASA Johnson Space Center, Houston, TX 77058.

Is it possible for a flight controller or even a flight director to become an astronaut?

It is possible for flight controllers to become astronauts, and this has happened many times. A few flight controllers get to become flight directors.

Training: How do the astronauts train using the robotic arm on Earth, seeing there is gravity? Would the arm support its own weight on Earth?

For robotic arm training, the astronauts use several different simulators, with each possessing its own strengths. The Shuttle Engineering Simulator and the Shuttle Mission Simulator are two computer simulators that are used extensively. Each one has actual switches and hand controllers to maneuver a computer model of the arm and the payload. Another heavily used simulator is the Mission Development Facility. This simulator utilizes real hardware, which includes a hydraulic robot arm, payload mockups, and cameras. To assist EVA operations, the NASA Neutral Bouyancy Labortory has an underwater robotic arm. This is used to train the crew in joint EVA and arm operations.

What specific roles are the commander and pilot responsible for during the mission?

The commander is the captain of the ship, making all real-time critical decisions on behalf of the crew and in coordination with the Mission Control Center. The commander also flies the Shuttle during approach and landing and is trained and ready to take over from the computers and fly at all other times. The pilot is the Commander's understudy and is fully trained to do all the same tasks as required. Commanders fly at least once as pilots before they move into the left seat. Both participate in experiments and onorbit operations, with some limitations. They are not allowed to perform spacewalks, as we cannot afford to have them stuck outside during an emergency deorbit. They also do not normally operate the Canadarm, as it is a specialized task separate from flying the vehicle.



How do I request a speaker?

Astronaut speakers may be requested through the Johnson Space Center (JSC) Astronaut Appearances Office at (281) 244-8866. General NASA speakers (scientists, engineers, etc.) may be requested through JSC Community Affairs at (281) 244-8024.

How can I borrow an exhibit from NASA for my school or event?

There are JSC exhibits that are available on loan to educational facilities and other nonprofit functions by calling the Exhibits Manager at (281) 483-8622.

How can I obtain photography associated with the space program?

Still photography may be downloaded from the World Wide Web or purchased from NASA's Media Resource Center at JSC at (281) 483-4231.

I am a teacher. How do I get material for my classroom?

NASA has several Educator Resource Centers (ERC) throughout the United States to serve educators. The JSC ERC, located at Space Center Houston, serves educators in an eight-state region (Texas, Oklahoma, Colorado, Kansas, Nebraska, New Mexico, North Dakota, and South Dakota). The phone number for this ERC is (281) 244-2129. To determine the appropriate ERC for other states, contact the JSC Resource Center at the same number.

I have a question about a planetary probe. Whom do I contact?

NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, is the Center responsible for planetary probes and maintains solar system information. The phone number is (818) 354-5011.

How do I get information on launch activities?

All human space launches occur at Kennedy Space Center (KSC). The phone numbers are (407) 867-7819 or (407) 867-INFO (4636).

How do I get satellite information?

Goddard Space Flight Center (GSFC) in Greenbelt, Maryland, is the NASA center responsible for satellite programs. GSFC has information on satellite images, the Hubble Space Telescope, space tracking, and space debris. The phone number is (301) 286-5566.

How does NASA receive and distribute my tax dollars?

Less than 1 percent of the Federal budget goes to NASA. The budget for NASA is administered at NASA Headquarters in Washington, D.C. Inquiries on this subject should be directed to (202) 358-1753.

Where can I find more technical information on NASA's research?

Requests for NASA technical publications and papers should be directed to NASA's Center for Aerospace Information (CASI) at (410) 859-5300, ext. 245.



Where do I get NASA souvenirs such as pens, caps, patches, and stickers?

NASA souvenirs may be purchased from the Space Trader Gift Shop at 1-(800) 746-7724.

Where can I get an individual picture of a particular astronaut?

Individual astronaut lithographs may be obtained by writing to Johnson Space Center, Mail Code CB, 2101 NASA Road 1, Houston, TX 77058-3696. Online portraits are also available.

I want to work at NASA. What college should I attend?

NASA does not recommend specific institutions or courses of instruction. Please contact accredited universities of your choice to determine whether instruction is offered in the aerospace field. The qualifications for becoming an astronaut are covered in the Astronaut Selection and Training Brochure, which can be obtained from JSC at the address listed above.

How do you know what time it is in space?

All the clocks on the Shuttle are set to Mission Elapsed Time (MET). The MET clock does not start running until the Shuttle is launched into space, and when it does start running, it starts right at midnight (1 hour after liftoff, it is 1:00 a.m.). Astronauts have a 16-hour day and then a sleep period. Mission Control uses both MET for the Shuttle and Central Time for public event times, so that everyone knows when particular events will occur on a mission.

How do you take a bath, brush your teeth, and go to the bathroom in space?

There are no baths or showers on the Shuttle, so astronauts just wash off with wet washcloths, using soaps that do not have to be rinsed off. When they brush their teeth, they can either swallow the toothpaste or spit it into a washcloth. Designing a toilet for zero gravity is tougher. The astronauts use air flow to make the urine or feces go where they want, because gravity will not do it for them.

